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NAVAL WAR COLLEGE  
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CONSIDERATIONS FOR THE EFFECTIVE APPLICATION  
OF RESEARCH AND TECHNOLOGY ON THE IMPROVEMENT OF U.S. COAST GUARD  
OPERATIONAL SYSTEMS AND THEIR EMPLOYMENT

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by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College, the Department of the Navy or the United States Coast Guard.

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## PREFACE

The United States Coast Guard has typically applied a narrow and short term planning horizon to its missions. There is evidence of this when newly commissioned operating systems and equipment designed to meet these missions, fail to completely serve them. The Coast Guard could do a better job of projecting what the future might hold in terms of political, economic, social and technological trends and the effect that such trends might have on future missions and the systems/equipment supporting them. They must not just talk Strategic Vision, they must act it to harvest any fruits it may have to offer. The Coast Guard would do well to look at its big sister service, the United States Navy, as an example to see the importance that is placed on Research and Technology in the Strategic Planning process. It should consider conducting its own "futures" study and cannot hope to rely upon Navy incentives in this area.

The Coast Guard appears to have a myopic view of Research and Technology. It wants an RDT&E function, pretends to see a need for it to have an impact on operations, and has often criticized the function for not being productive in that regard. A tendency to pump more funding into the program to achieve this purpose is evolving. This increased "level-of-effort" could be of benefit but only if applied properly. However, doctrinal, institutional and organizational changes must be considered, as well, that can assist the program in becoming more productive.

The analysis that follows compares the DOD/Navy R&D process with that of the Coast Guard. Should the USCG R&D process be the mirror image of the Navy's? Certainly not! Should it continue to function as it has

since its inception in the late 1960's? I hope not! The analysis is supported by appropriate research documentation and every attempt is made to ensure that conclusions are supported by related findings. It should go without saying (but it won't!) that the study is supported by the author's thirty years of combined experience in private sector, DOD/Navy, and USCG employment covering ship and ship systems design and construction and a plethora of related marine engineering and RDT&E experience. The highly qualified support of Earle Messere, Technical Director of the U.S. Naval Underwater Systems Center (NUSC) and his Executive Assistant Robert Beaver is truly appreciated in providing supporting data as well as performing as a sounding board for elements of this paper.

Finally, I must say that the only agenda underlying this study is the expectation that adoption of proposed changes, in part or in their entirety, will serve to improve the image of the Coast Guard R&D organization as one that can have an important effect on improvements in Coast Guard operations.



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## CHAPTER I

### INTRODUCTION AND APPROACH

The extent to which resources are applied toward the conduct of Research and Technology by government or private sector organizations is totally dependent on the nature of the end product or service that the organization provides and the nature and complexity of processes required to develop/provide those products/services. In the private sector innovations resulting through successful efforts in research help maintain a competitive edge over other businesses. In the government sector the edge may be required to stem a potential threat in support of national security or simply ensure that the agency mission is carried out as efficiently as possible in support of the public trust. In some cases, particularly in certain government sectors severely constrained by personnel and budget resources, the extent of independent research is bounded, fostering the practice of "piggy-backing" on the efforts of others and applying established results to developmental programs in effect "adopting or adapting technology to the specific things we need it for."<sup>1</sup> This is certainly a wise method to pursue but the trick to its effectiveness is relating the output of others efforts in these areas to the timely input to your requirements and needs for systems development. To effectively conduct such an effort a planning approach is required to ensure that technologies developed are brought through the "proof of concept" stage and are in fact available to link up with an acquisition program.

In any event, it is a certainty that research and technology efforts conducted at appropriate levels toward conceptualization and development of operational systems provides insurance for efficient and effective organizational mission performance into the future. Private industry and government organizations understand and support the need and typically devote from 5% to 15% of gross receipts or total budget respectively, toward its accomplishment. The expenditure is considered an investment in the future in terms of reducing the risks of doing business. As stated earlier in the case of private industry, risk reduction assures continued favorable standing among competitors. In the National Security arena maintaining a leading edge in engineering and technology helps to avoid technical inferiority in military force structure which can contribute to an unfavorable balance of power, in fact, "Our economic and military strength rests on our technological superiority."<sup>2</sup> Many of the Coast Guard missions are conducted in support of the National Security Strategy of the United States. It follows then that Coast Guard research and technology, conducted at appropriate levels can contribute measurably to that strategy and as well to its non defense roles by reducing the risk of operational systems not meeting the needs of that services varied and changing missions.

In addition to the emphasis on level-of-effort there are organizational and institutional procedures that R&D conducting organizations concern themselves with to ensure maximum effectiveness of the R&D program in terms of its impact on operations. First, to provide assurance that a serious user (operator) supplier (R&D) dialogue transpires in the development of meaningful requirements, the management

and oversight of the RDT&E function is usually attached at the corporate level and the function is directly and firmly linked with the organizations acquisition strategy. This position signals the view of the corporate management on the importance of the function and helps provide the impetus throughout the organization for the effective implementation of R&D efforts into the operational arena. Secondly, the inherent nature of R&D work necessarily entails programs that can take a few years from their inception to eventual incorporation into a major system. To maintain stability through this project life cycle, organizations also find it necessary to build continuity of management into the R&D program particularly at the R&D Program Manager level. In military agencies this is accomplished by the assignment of competent senior civilians to the R&D Program Management role.

In the light of these prescribed "tenets" for conducting effective Research and Technology, this paper provides some views on the USCG RDT&E Program and its effectiveness in impacting on Coast Guard operations. Through the use of some historical examples it builds a case for the value of Strategic Planning and the impact that process can have on operational systems via the technology process. It provides a comparison of the USCG R&D process with that of DOD/Navy, highlighting some areas where adapting elements of the latter could improve productivity of the USCG R&D program. Finally, as part of the USCG/Navy comparison it presents a brief analyses of organizational and institutional processes against that of the private sector and DOD/Navy and suggests changes that if adopted would enhance the long term effectiveness of the USCG R&D programs on Coast Guard operations.



## CHAPTER II

### THE PAST AND THE FUTURE--MANDATE FOR STRATEGIC PLANNING

Going back to the mid 1960's and looking forward we see a fleet of 210-foot medium endurance cutters (WMEC) entering duty for the primary purpose of conducting search and rescue (SAR) and for secondary use in law enforcement (LE) activities. These ships, having a speed of 18 knots, are still in operation. They are very lightly armed and can accommodate helicopter operations with some restrictions. The Coast Guard also has a host of other WMEC's dating from as far back as 1941 and ranging in size from 180-feet to 270-feet. It is safe to say that the 210's are still a viable resource for SAR and LE duties but it is certain that these particular ships have virtually no use in a real Defense Readiness role in joint operations with the United States Navy today. Although defense operations has always been in the Coast Guard menu in some form or another, it is clear that provision for a possible military contingency use of these ships twenty plus years hence was not in the cards. In 1975, the acquisition process began for the most recent WMEC design, the 270' Famous Class Cutter. When originally conceived there was a deviation from the usual Coast Guard multi-mission view in platform procurement and the design was based upon a fisheries patrol mission. In 1979, the Carter Administration banned the Soviet Fishing Fleet from operating in our 200 mile exclusive economic zone (EEZ) as a sanction against their invasion of Afghanistan. This procurement proceeded without change, providing the Coast Guard with a rather slow cutter (<20 Knots). Although there was

"space and weight" margin available for weapons systems retrofit, this platform's capability as a defense readiness asset and its interoperability with Navy ships is questionable principally due to its low speed. The 378 foot high endurance cutter (WHEC) class were introduced in the late 1960's. Although they were to be multi-mission platforms one of the missions was Ocean Station duty wherein they were to perform weather station and navigational aid functions and would also be available as a SAR platform. The Ocean Station program was abolished, however, stripping this ship of a principal mission for which it was designed. Ironically, by chance and not by design, the 378 WHEC of all the cutter classes has the most capability for utilization as a contingency and limited warfare (CALOW) platform.

In the 1970's some interest evolved within the Coast Guard in Lighter-Than-Air (LTA) vehicles. These platforms, better known as "blimps" were given a hasty evaluation for utility as multi-mission surveillance platforms with emphasis on the drug interdiction element of LE. At about the same time the Aerostat platform emerged as a competing system. The Aerostat is a gas filled flexible balloon which can either be land based (fixed) or ship based (mobile) and is designed to contain a radar system with a down link to ship/shore. The effectiveness of such an aerial borne radar system for surveillance of drug running activities was clear particularly in terms of endurance capabilities as measured against fixed wing and helicopter based systems. The Aerostats were procured and are in operation today by the Coast Guard and other agencies involved in the "War On Drugs". The effectiveness of Aerostats is questioned in a March, 1990 report by the U.S. General Accounting Office (GAO):

"Aerostats are weather sensitive and, as a result, are sometimes inoperable for extended periods of time. Because of their sensitivity to even mild winds and the possibility of damage, aerostats must be reeled back to their base in advance of approaching winds. These weather conditions while affecting aerostat operations, often do not affect the operations of small aircraft."<sup>3</sup>

In the same report concerns are expressed with regard to the effectiveness of helicopters in the effort. A thorough systems analysis of competing aerial surveillance systems might have identified potential problems at the outset resulting in a different force mix. The decision to go with Aerostat, however, was based primarily on cost and availability considerations and with a single mission in mind.

During the mid 1970's the Coast Guard mounted a high priority effort in support of the Marine Environmental Protection Mission. Equipment was procured for use by environmental "Strike Teams" and R&D was conducted on innovative methods for stemming the flow of oil and hazardous materials from stricken tankers and barges. Extensive efforts went into the development of oil off-loading systems and spill containment and clean up gear. This effort all peaked in the years following the ARGO MERCHANT accident off Cape Cod in 1976. Drug Enforcement soon took the center stage and drew the Coast Guard into a shift in that direction. The grounding of the EXXON VALDEZ in Prince William Sound Alaska in March of 1989 came back to haunt the Coast Guard in its difficult mission of trying to do all things well. In October, 1989, a report by the GAO to the House Committee on Merchant Marine and Fisheries stated:

"Oil spill clean up procedures and technologies are primitive...with current technology the best that can typically be expected after a major spill is to recover 10 to 15 percent of the oil. Notably, however, while concern exists that response technology has not changed much since the 1970's, federal funding for R&D has been cut back in recent years...in

1988 the Coast Guard's budget for RDT&E in its Marine Environmental Protection Program, of which oil spill response is only a part was 1.6 million--7.2 million less than expended in 1983."<sup>4</sup>

Similar concerns are cited in a GAO report regarding spill preparations in New York and Philadelphia ports.<sup>5</sup> The Coast Guard is now involved in a massive build up in support of marine environmental response.

These examples are provided simply to support the idea for "hedging uncertainty" in the development of operational and technical requirements for future systems as a conservative means to ensure that these systems will meet planned and changing missions. This process of course has its cost and may be unaffordable. A better thing yet is a workable "crystal ball" that in reality could come in the form of a Strategic Plan that recognizes the changing nature of events leading to better predictions of future mission needs. Current methodologies are in vogue in the form of "futurism". Engaging in futurism it is said, will not predict unerringly what tomorrow yields, but will better understand how policies, programs and habits may affect the future.<sup>6</sup> Forecasts can be made using the "technology push" approach which is innovative in nature and unhindered by constraints of policies and budget, or, by "requirements pull" which identifies the future threat and mission needs for future years. The former may tend to be impractical and lead to unfulfilled expectations. A compromise between the two is the likely choice. The concepts of "technology push" and "requirements pull" relate to the influence of "supply" (technology push) and "demand" (requirements pull) on shaping research and development programs. Technology push is a matter of what is technologically feasible and of the eagerness of the R&D community to do

what can be done; while requirements pull concerns what needs doing to solve problems barring attainment of needed operational capabilities.<sup>7</sup>

"Navy 21" a comprehensive study of the implication of advanced technology on the U.S. Navy in the next century is a highly credible futures study recently conducted by the National Academy of Science, Naval Studies Board (NSB). Technology assessments conducted by the NSB were based on a view of technological development over the next 10-20 years but with the expectation that anticipated developments will influence the Navy over a 30-50 year period. Their approach was clearly a combined "technology push - requirements pull":

"The Navy of the twenty first century will be shaped both by technology driven forces that move it away from current forms and systems, and by technological opportunities to solve mission oriented problems, helping to carry out maritime warfare missions more effectively."<sup>8</sup>

Given that 20-20 hindsight is available but workable crystal balls are not -- it might be of some benefit to the U.S. Coast Guard to conduct a similar "futures" effort.

## CHAPTER III

### A BASELINE FOR COMPARISON - USN RDT&E/ACQUISITION (RDA)

#### DOCTRINE-ORGANIZATIONAL AND INSTITUTIONAL ENVIRONMENT

The U.S. Navy RDT&E process is directly integrated into that services' acquisition strategy. In fact RDT&E is considered to be a "subsystem" of the Acquisition Process. The title of the guidance document for management of the process "RDT&E/Acquisition Management Guide" (NAVSOPUB 2457) sends a clear message with regard to the relationship between the RDT&E and acquisition roles in the Navy. The product of the RDA effort is an operational capability. The function of R&D in the development of operational capabilities is the production of information required to achieve such capabilities. In turn it is the function of the acquisition activities to produce those capabilities. The process recognizes that some needed capabilities can be achieved without new information and therefore are not R&D problems. The function also recognizes the importance of integrating R&D into the major system acquisition process as well as into smaller acquisitions that do not fit the rigid requirements of OMB Circular A-109. A prominent point here is that the guide for conducting all forms of RDT&E is addressed in one doctrine which is directly and firmly linked to the acquisition process. The RDT&E Program is organized into six categories: Research (6.1), Exploratory Development (6.2), Advanced Development (6.3), Engineering

Development (6.4), Management and Support (6.5) and Operational Systems Development (6.6).

DOL/Navy doctrine requires that, to enhance its overall value to the Navy, RDT&E programs must not only be considered as on-going producers of science and technology, but they must also be thoroughly alert to the present and future operational requirements of the Fleet. To satisfy this requirement, it is mandatory that first, the program, through its centers and laboratories,

"...understand the operational problems of the Fleet, potential threats, and the capabilities and limitations of its personnel and its organization; and, secondly, the activities be so placed and so used that they have an important voice in systems decisions and planning."<sup>9</sup>

Appendix I indicates the attachment of the management and oversight for the RDT&E process at the highest level in the organization--clearly distanced from the Systems Commands (SYSCOMS) in terms of control. In this manner, the R&D program is assured serious support but more importantly the impetus is provided for driving the "hand off" of viable R&D efforts into the acquisition program via the Program Manager residing in the SYSCOMS. Civilian oversight is provided to the R&D program through the Assistant Secretary Research Engineering and Systems (ASN RE&S), who is the only civilian executive assistant to SECNAV to control an appropriation. It can also be seen that the requirements development process for R&D (under control of Director Research & Development Requirements T&E (R&DR, T&E)) has high level support (CNO). In a recent address at the U.S. Naval War College in Newport, the CNO stressed the importance of the requirements process and the strength of the technology

support role to operations, thus eliciting an interest and understanding at the highest level within the Navy of the strength of that relationship.<sup>10</sup>

The Navy RDT&E budget averages ten percent of the Navy operating budget. Approximately ten percent of the R&D budget goes to combined 6.1 and 6.2 or the "Technology Base". A rough break out by percent of total R&D budget (FY90) is 6.1 [3.8%], 6.2 [4.6%], 6.3A [2.3%], 6.3B [20%], 6.4 [47%] and 6.6 [17%].<sup>11</sup> Naval laboratories and centers conduct RDT&E work over the spectrum 6.1 to 6.6. A review of the Naval Underwater Systems Center (NUSC) revealed this to be the case.<sup>12</sup> NUSC operates on an approximate 50/50 ratio of in-house/contracted effort. It is of interest to note that NUSC (as well as several other technology centers) use the same engineers and scientists who conduct projects funded by RDT&E, to conduct related technical efforts from other appropriations e.g. SCN (Shipbuilding and Construction), and OM&N (Operations and Maintenance). These latter forms of funds roughly compare to ACI (Acquisition, Construction, Improvement) and OE (Operating Expense) in Coast Guard appropriations. As a result, efficiency gains are realized at the center and a synergy develops between those who conduct the longer term technical efforts with those who have an understanding and need for timely solutions to today's problems. It recognizes the "ivory tower" capability to contribute engineering solutions to current Fleet problems using a common resource. This process better utilizes a trained engineering/scientific work force and provides flexibility when budget climates demand changes in



emphasis between RDT&E and other forms of funding. Centers/laboratories operating in such a way are termed "full spectrum" labs.

NUSC employs approximately 3500 people, of which 2100 are scientists and engineers. There are, on average, 65 junior officers engaged in project engineering duties. These officers are normally post graduate trained and work as assistants to civilian scientist/engineer project managers. These billets are viewed as training assignments to qualify for a future SYSCOM project manager role. Infusion of operational reality into technical efforts is, as a matter of doctrine, required of, and entrusted to, the predominantly civilian laboratory/center staffs.

The Center Technical Director of NUSC has the principal role in developing the program from requirements elicited from Director (R&DR & T&E) and Chief of Naval Research. These requirements are tied to satisfying requirements for acquisitions elicited by the Program Managers in the SYSCOMS. Navy Technology Center/Laboratory Technical Directors typically interface at the Flag or Flag deputy (SES level) in SYSCOMS.

#### PROCESS

The six RDT&E program categories (6.1 - 6.6) are summarized below. These categories are commonly referred to by their numbers only (as will be throughout the remainder of this paper). Appendix II depicts the R&D process and its relationship to the acquisition process. An inherent (and important in terms of this paper) characteristic of this process is the inverse relationship between cost and uncertainty. In other words in the Research Phase (6.1) uncertainty is high with low cost whereas in the

Systems Development Phase (6.6) cost is extremely high and uncertainty is relatively low.

6.1 RESEARCH - Scientific, study and experimentation to increase knowledge and understanding in the physical, engineering, environmental and life sciences related to long term national security needs.

6.2 EXPLORATORY DEVELOPMENT - This effort is directed toward specific problems to develop and evaluate the feasibility and practicality of proposed solutions. This category may range from fundamental applied research to sophisticated breadboard hardware and often involves an emphasis on "study" type efforts.

6.3 ADVANCED DEVELOPMENT - The prime objectives of this phase is "proof of concept" rather than the development of hardware for service use. An important distinguishing feature within this category is the breakout of 6.3A "Advanced Technology Demonstration" -- where early examination of the feasibility of alternative concepts takes place and 6.3B "Advanced Development" where through extensive analyses and hardware development principal program characteristics are validated. It is important to note the 6.3 is the first element of the R&D process that becomes seriously integrated into the acquisition life cycle. Although the lines of departure are not firm and solid , it can safely said that 6.3A is closely associated with the Concept Exploration and Definition Phase where 6.3B is in turn intertwined with the Demonstration and Validation (D&V) phase of the acquisition process.

6.4 ENGINEERING DEVELOPMENT - Includes programs in the Full Scale Development phase of the acquisition cycle but which have not received approval for production or had production funds included in the budget.

6.5 MANAGEMENT AND SUPPORT - Includes support of installations or operations required for general R&D use. (This element is not pertinent to the context of this paper).

6.6 OPERATION SYSTEMS DEVELOPMENT - A category that supports continuing needs for RDT&E in advanced stages of the Full Scale Development phase of the acquisition life cycle.

Hand-offs typically begin to feed from the R&D process into the acquisition cycle during the 6.3 phase.

#### FEATURES

- \* Complex yet highly organized and structured process. R&D and acquisition directly and firmly linked.
- \* Effective "hand off" of R&D Product by acquisition link.
- \* High level visibility within organization to make it work.
- \* Realistic and serious nature of R&D requirements process. Forward and backward linked through SYSCOMS and into acquisitions.
- \* Tendency toward civilian program oversight (continuity feature) and confidence in civilian program management.
- \* 6.3A and 6.3B are where support momentum and operational need is born. (ensures hand-off) "6.3A is where you get the "Requirements Pull" from the user. Operators learn they want these things and lobby RDT&E/acquisition to go to 6.3B and 6.4".<sup>13</sup>
- \* Labs/Centers tend to be "full spectrum" leveraging economy of trained scientific/engineering force.
- \* Extremely low military to civilian mix at centers and labs.
- \* Respect and need for R&D function and its potential impact on operations via acquisitions, is universally broadcast and understood throughout the Service.

## CHAPTER IV

### THE USCG RDT&E PROGRAM BY COMPARISON

#### DOCTRINE - ORGANIZATIONAL AND INSTITUTIONAL ENVIRONMENT

The USCG R&D program can be characterized as a systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet particular requirements. The Coast Guard's R&D Program focuses on applied research and application of technology developed by other government agencies and the private sector to the Coast Guard use. The R&D Program is responsible for monitoring the total Coast Guard involvement in research and development.<sup>14</sup>

The Research and Development Program in the Coast Guard was formed in the late 1960's. All RDT&E effort conducted with funds from that appropriation are conducted through the U.S. Coast Guard Research & Development Center, Groton, Connecticut. Currently the program consists of approximately 100 people with a budget of \$25M. Over the years the focus of the program, as in other government agencies, has changed from one of a mixture of in-house and contracted efforts to a current focus principally on technical contract administration. Certain efforts are conducted in-house that are so unique to the Coast Guard and its functions that they would be inefficient to contract out. The RDT&E budget expenditures amount to less than one percent (.67%) of the total Coast

Guard budget. This is a significant deviation from the ratio of R&D expenditures by other agencies (Appendix III) It is currently proposed to increase this to two per cent (2%) over the next few years. The program is currently managed through a small staff (G-Er; 13 people) placed within the Office of Engineering, Logistics and Development (G-E) and as such is a weak sister to four other "Divisions" [e.g. Aeronautical (G-EAE), Civil (G-EVC), Naval Engineering (G-ENE) and Logistic Management (G-ELM)] within that office (Appendix IV). In this "peer" position it serves to support program managers in Coast Guard operating and support programs in the Divisions resident in other offices, e.g. G-N, etc.

The Coast Guard Acquisition process is managed by the Office of Acquisition (G-A). The acquisition process within the Coast Guard is conducted under the guidance of "Systems Acquisition Manual" COMDINST M4150.2. This guidance conforms to many of the procedures established in the DOD Major System acquisition process in particular NAVSO P2457 but has logically been tailored to be USCG specific. The integration of the RDT&E process into USCG Acquisition strategy is expressed by the following reference,

"Research and Development Center. The Research and Development Center conducts applied research and develops operational techniques, concepts, equipment, and materials in support of operational Coast Guard programs. PMS may solicit participation of Research and Development center personnel in the Concept Exploration and Demonstration and Validation project phases. In certain instances, the Research and Development Center may be assigned the lead role in test and evaluation of a new system."<sup>15</sup>

There are few other references in this acquisition guidance document to the RDT&E process. This manual is oriented primarily toward major systems acquisitions but is applicable to smaller projects as well.

Appendix V shows the Coast Guard organizational interface for Systems Acquisition. It can be seen that Engineering (under which R&D resides) is a "player" in the Requirements Definition process. The R&D function and relationship between R&D requirements and acquisitions is not shown as a feature of the acquisition process. Civilian oversight for the acquisition program is at the Deputy Secretary level in DOT. Appendix VI depicts the organization for acquisition within the Coast Guard. The Vice Commandant of the Coast Guard is the agency acquisition executive (AAE). A Coast Guard Acquisition Review Council (CGARC) chaired by the AAE conducts project reviews to "...ensure top management's commitment to the projects' acquisition strategy and plans."<sup>16</sup> The Chief of the Office of Engineering, Logistics and Development (G-E) is a member of the CGARC and as such has the responsibility to review each acquisition at key points in the process with a view toward RDT&E, Naval, Civil and Aeronautical Engineering and Logistic Management efforts in support of acquisitions. Since requirements for RDT&E programs seem to be uncoupled with the acquisition process it is unclear how the RDT&E program advocate introduces the progress and impact of R&D efforts within the CGARC forum.

The requirements determination process for R&D is covered in the instruction governing the R&D program (HQINSTR 5401.4C) and requires that sponsors, "Be conscious of opportunities for R&D to support their programs and submit Requests for R&D support as needed."<sup>17</sup> The support link between the R&D program and program managers exists by way of the "Request for R&D Support". The link between the acquisition process and these same program managers exists and is expressed through the formal guidance for acquisition management. However there appears to be no serious or

effective relationship linking the progress and output of RDT&E and any acquisitions through these program managers. Or put in another way, there is uncertainty as to how the requirements for R&D support from the program managers fit (as a subset) into the requirements process established by program managers for new acquisitions. In summary it appears that contrary to the USN recognition that some acquisitions won't require new information (R&D)--there is an implication that the Coast Guard considers that most acquisitions will not require new information(R&D).

The program provides for an approximate 40/60 ratio of military to civilian with the expectation that a continuous infusion of operational realism enters all efforts. In reality, the most officers entering a tour in the program are typically O3 level with one sea duty tour and a post graduate degree in engineering or physical science. Recently, due to billet assignment pressures elsewhere in the Service the tendency has been to fill vacated billets with non-post graduate trained officers resulting in some degraded capability from the technical perspective.

Although the Coast Guard R & D Center has an SES grade Technical Director the authority vested in this position does not provide a serious capability to interact with other operating and support program directors and provide high level continuity. The nature of the Coast Guard organization is such that Senior Executive deputies to program and support managers do not exist to any consistent degree therefore negating a communications continuity at this level.

## THE PROCESS

The USCG RDT&E program by doctrine does not include basic research (6.1). It is assumed that this element of the "Technology Base" will be conducted by other government agencies and private industry. The Coast Guard R&D program (Appendix VII) is principally involved in the equivalent of Exploratory Development (6.2) involving paper studies with limited breadboard prototyping efforts. Hand-offs are conducted after this phase to program and support managers. Much of what Navy considers Advanced Development 6.3 and all Engineering Development (6.4) and Operational Systems Development (6.6) is conducted by Coast Guard program and support managers as non R&D efforts (e.g. OE or AC&I- equivalent to OMN and SCN in Navy funding). The transition of a hand-off from R&D into operational systems is thwarted by this abbreviated process. Once a hand-off is accepted by the customer he must acquire the resources to continue the effort. This process is tied to the PPBES process and results in a two year hiatus before funds are available for project continuation. This period can result in waning interest, shifts in personnel and introduction of competing priorities. As well, the hand-off has usually not progressed to the stage where the user has established the leverage for validating the need to continue the effort. Complicating this is the nature of the process whereby the object of the hand-off is not keyed in any way to a system acquisition through the acquisition philosophy.



## FEATURES

- \* Simple system abbreviated in form compared to DOD/Navy
- \* R&D and acquisition very weakly linked
- \* Effective "hand-off" not accommodated by process. Too little too early. Momentum disrupted.
- \* Requirements process RDT&E <--> program manager <--> acquisition not clear.
- \* Coast Guard institutional avoidance of high level civilian continuity.
- \* No real 6.3A and 6.3B equivalent done within RDT&E. Support momentum for operational need disrupted.
- \* R&D Center not "full spectrum," therefore could not conduct 6.3 or 6.4 type efforts with OE or AC&I funds (by definition of R&DC).
- \* Relatively high military to civilian mix at R&DC--not a problem, but military resources might be better utilized elsewhere and civilian scientists and engineers substituted.
- \* Respect and need for R&D function, and its potential impact on operations via acquisitions, is not universally broadcast and understood throughout the Service.

## CHAPTER V

### WHY COMPARE?

#### STRATEGIC VISION AND TECHNOLOGY

The Commandant of the Coast Guard in eliciting support for its missions has issued a Strategic Agenda in which he also recognizes the importance of research and technology and capital asset acquisitions in the accomplishments of the Coast Guard mission:

"The Coast Guard must project future needs for equipment, capital and real property, and assess the condition, life expectancy and utility of its inventory to meet current and future requirements;" "...maintain a capital asset acquisition plan to meet current and projected needs"; "...conduct a research, development, testing and evaluation program which surveys new and existing technologies which meet Coast Guard specific requirements or which would enhance the Coast Guard's ability to provide efficient, cost effective service."<sup>18</sup>

This agenda could be a first step for the Coast Guard in support of the Secretary of Transportation's National Transportation Policy incentive aimed at a comprehensive assessment of how best to meet the nation's transportation needs over the next decade and into the 21st Century.<sup>19</sup> The agenda could lead to the development of a true strategic planning process within the Coast Guard which would force its way down into the Operating and Support program directorships within the organization. In this fashion the truly long range "visions" of the Coast Guard will be developed in a top down fashion eventually forming the basis for a research and technology program that will be supported at a level capable of addressing a range of short, mid and long term initiatives to assist in

meeting current and future requirements. However, should the standard process of developing the Commandant's "Long Range View" become the end result, virtually nothing new will have been achieved. The latter has been accepted as being the Coast Guard's strategic vision to the future when in fact it's range is at best five years and is never based upon a critical analysis of Coast Guard roles and missions formed from a view of world and national, political, economic and social changes in the 10 to 20 year time frame. This inherent weakness is exemplified in comments made in a GAO report to the House Committee on Merchant Marine and Fisheries, April 1990, on the subject of Coast Guard Information Resources Management (IRM) Programs. In essence the report cites a need for strategic focus, the need for the support of the organizations top management and:

"...a clearly articulated vision of how technology can help the organization achieve its objectives and a concrete plan for implementing this vision."<sup>20</sup>

By comparison the importance that the Navy places on Technological Strategic Planning is evidenced in the "Navy 21" futures study. This is not the kind of study that the Coast Guard can "piggy-back" on. It must develop its own technological strategic plan to ensure that future operational systems and their employment will meet mission needs through better employment of technology.

#### THE R&D PROGRAM

In concept, the Coast Guard supports RDT&E. The Commandant expresses support for it in his Strategic Agenda when he alludes to the R&D program's capability to produce efforts that would meet "Coast Guard

specific requirements" and enhance the Coast Guard's ability to do its job well. At the same time, his vision statement recognizes the importance of an acquisition program aimed at "meeting current and future requirements." The Commandant has clearly expressed the importance of service mission requirements to both the RDT&E and acquisition processes. Yet a firm link between the RDT&E and acquisition programs is lacking.

The Commandant in his State of the Coast Guard Address, 14 March 1991, says of the R&D program, "We're making it more results-oriented, more program directed, moving away from pure R&D, moving toward applied R&D...".<sup>21</sup> In fact, the Coast Guard R&D program by doctrine has always been applied in nature and excluded pure or basic research in totality. The intent of the Commandant's comment is clear, however, to anyone having long term intimate knowledge of the R&D program. What he means is: Meet the program managers' real requirements and produce hand-offs that provide positive impact on operating programs. Where is he coming from?

Over the years the Coast Guard R&D program, in varying degrees, has suffered credibility problems. It has been scrutinized for not supporting the needs/requirements of operating and support programs resulting in low productive input to operational systems. Lack of capability or productivity within the R&D program itself cannot be cited as the reason for these alleged shortcomings. Many proposed improvements to operational systems have resulted from R&D projects. These projects were worked from program managers' requirements and project progress was continually monitored by the customer up to the point where apparent successful hand-offs were conducted. Many of these hand-offs, in turn, were never implemented into operational systems.

R&D hand-offs have failed to materialize into operational systems for several reasons. First, the system or concept developed and handed-off often has not passed through the Advanced Development stage (6.3) where the idea gains the maturity to generate true user interest, generating "requirements-pull." Secondly, the products of R&D are not in any way tied into the acquisition cycle thwarting the focus and discipline required to assess their value for incorporation into newly acquired systems and hardware. Thirdly, even if a product for R&D attains the hand-off in a state of completion that can qualify for production/procurement, there is a hiatus in the funding process required to advance to the next step. This presents an impediment to the smooth transition of the R&D product into an operational system or hardware and is often the cause for indefinite delay or shelving of the effort. Fourth, the R&D program acts on a par with other Divisions in Operating and Support Program offices and may be viewed as a competitor. In this way meat and potatoe projects of a 6.3 nature that directly support acquisition may be retained to be conducted in Headquarters with OE or AC&I funding (therefore not becoming R&D requirements in support of acquisition). R&D program advocacy through attachment at a higher level in the organization (Office of Chief of Staff G-CCS) would parallel the DOD/Navy and private industry alignment of the function and serve to alleviate some of these concerns. Formally linking the R&D program to the acquisition process would provide additional benefits.

Why is the R&D program not firmly linked to acquisition?

Essentially, the Coast Guard has established a process whereby most Advanced Development, Engineering Development and Operational Systems

Development (6.3, 6.4, 6.6) efforts are conducted in the Technical Branches of the Program and Support Managers using non-R&D funding. The acquisition process is designed to interact with these programs and not with R&D. R&D can operate far more effectively within this unique process, however, by taking more of its projects from the Exploratory Development phase into and through Advanced Development, before hand-off. To accommodate that process, the R&D budget should be increased not by doing "more of the same" but by conducting more proof-of-concept pre-prototyping efforts and handing off a more complete product. The proposed revision to the process, Appendix VIII, requires that the program manager initiate the request for resources to carry the R&D hand-off into the equivalent of Engineering and Operational Systems Development and to production at a key decision point. This key decision should be made roughly two years prior to the proposed new hand-off event and would coincide roughly with a preliminary hand-off at the end of the exploratory development phase. The program manager has to decide at the key decision point which "winners" having very high probability of being incorporated into an operational system should be pursued in this fashion. Implementing such a change would result in a more effective R&D hand-off process and the increased R&D budget would be most effectively utilized. Some provision for R&D scientists and engineers to conduct selected efforts in support of program manager technical staffs, using other than RTD&E funds, could also serve to compliment support to acquisitions and to develop a stronger tie between R&D scientists/engineers and program manager technical staffs.

## CHAPTER VI

### RECOMMENDATIONS/CONCLUSIONS

1. Conduct a bold "futures" study that actually challenges the future of the Coast Guard, its roles and missions, and is not based upon the premise that we will be limited to the missions that we now know. The scope and planning horizon for this effort should be similar to that of Navy 21 and the conducting organization should be of similar caliber as the Naval Studies Board. This study could form the basis of a technological strategic plan for the Coast Guard. Pursuit of research and technology efforts (whether they be conducted under the aegis of the R&D program or not) in support of such a plan would provide insurance for effective and efficient mission performance in the future.

2. Consider the placement of the RDT&E Program (current G-Er Staff) as an element in the Chief of Staffs Office where it is distanced from control by any operating or support program. This position will provide the necessary support throughout the organization for a more efficient use of the R&D program resources.

3. Tie the R&D program directly and firmly to the acquisition process (whenever and wherever it can be) to ensure that R&D products are developed to requirements that are in fact supportive of actual future acquisitions or operational system improvements. This will force improvements into the hand-off process.

4. Fund R&D efforts to continue through the 6.3A and 6.3B phases prior to hand-off to a program manager. This will reduce the uncertainty

of the product having operational value and will provide a mature hand-off to be integrated into the acquisition process. Building the budget to do "more of the same" could spell disaster for the R&D program. Without process improvements, which put teeth into the requirements and hand-off processes, more money could be spent with little apparent improvement or effect of the R&D program on Coast Guard operational systems. This could create a return to the environment of late 1981 when the program was on the chopping block for the same reason.

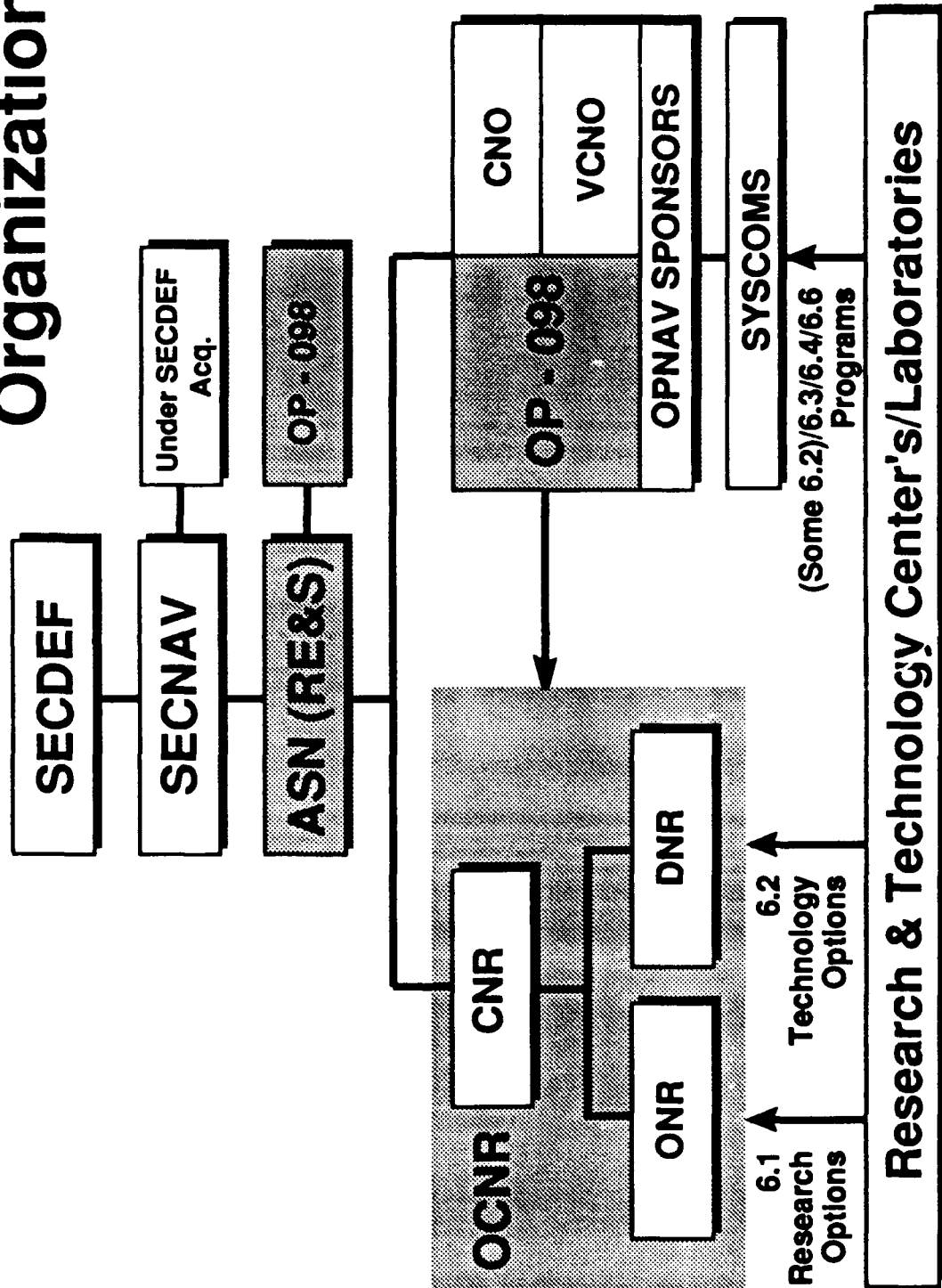
5. Consider the civilianization of more military billets at the R&D Center particularly where assignment exigencies elsewhere in the service are forcing assignments of non post graduate trained junior officers into "out of specialty" jobs in the R&D program.

6. Consider using the R&D Center as a "full spectrum" Laboratory that can conduct engineering efforts with other than RDT&E funds.

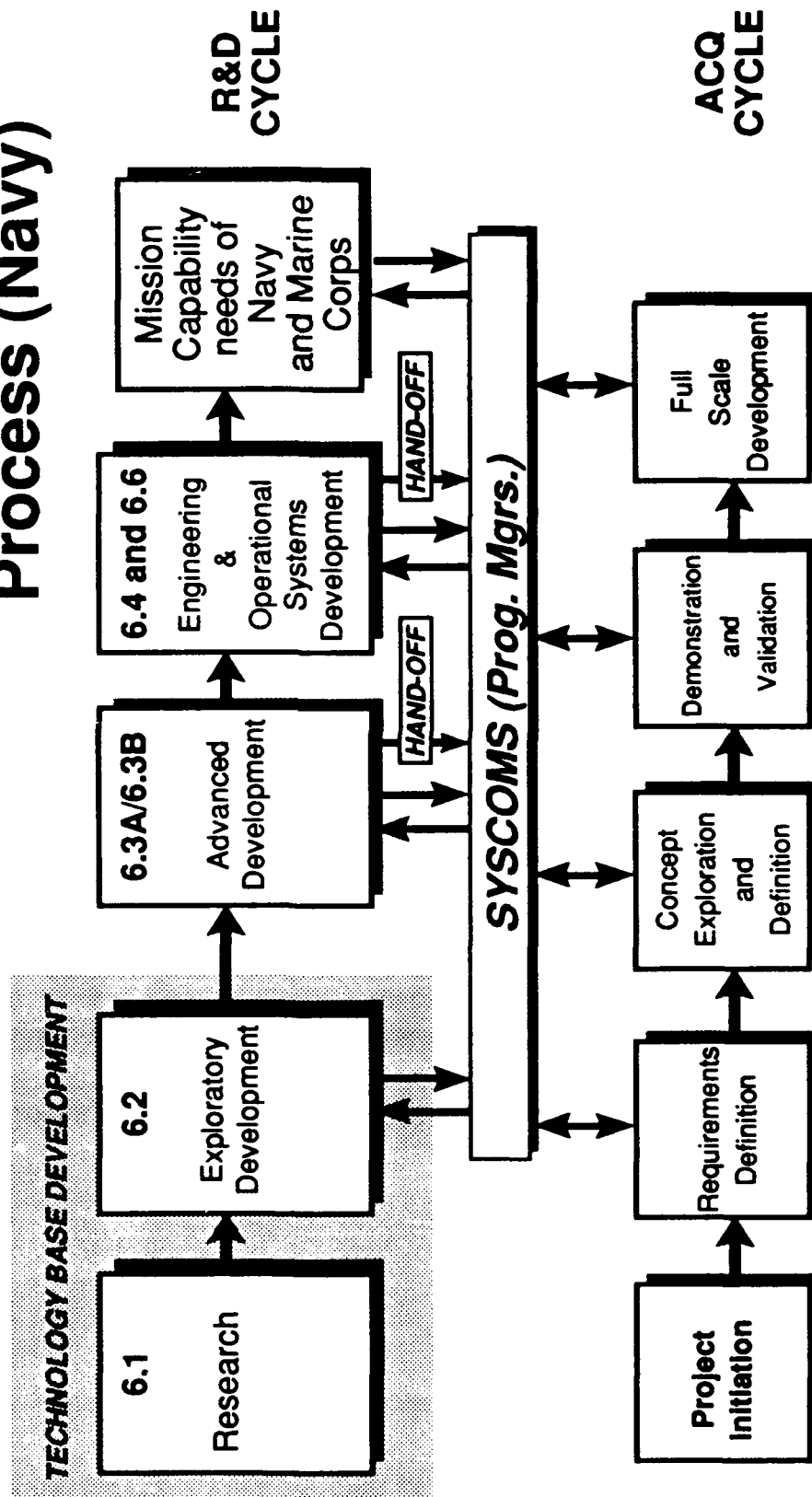
7. The Navy and USCG are very different organizations in terms of mission, size, and complexity. To suggest that the Coast Guard should fashion its R&D program in the image of the Navy's would display naivety of the source. Superior performance is the best prescription for respect and credibility. The Coast Guard R&D Program has worked hard in this regard over the past several years. There are obstacles however that impede the program's ability to succeed and this paper has hopefully highlighted some of them. Doctrinal, organizational and institutional changes can be implemented to lower these obstacles providing assistance to the program in its objective of providing a positive impact on Coast Guard operational systems of the future. The DOD/Navy model offers some lessons that can be taken away.



# DOD/NAVY Research and Development Organization



# Functional View of Defense Research-Development-Acquisition (RDA) Process (Navy)

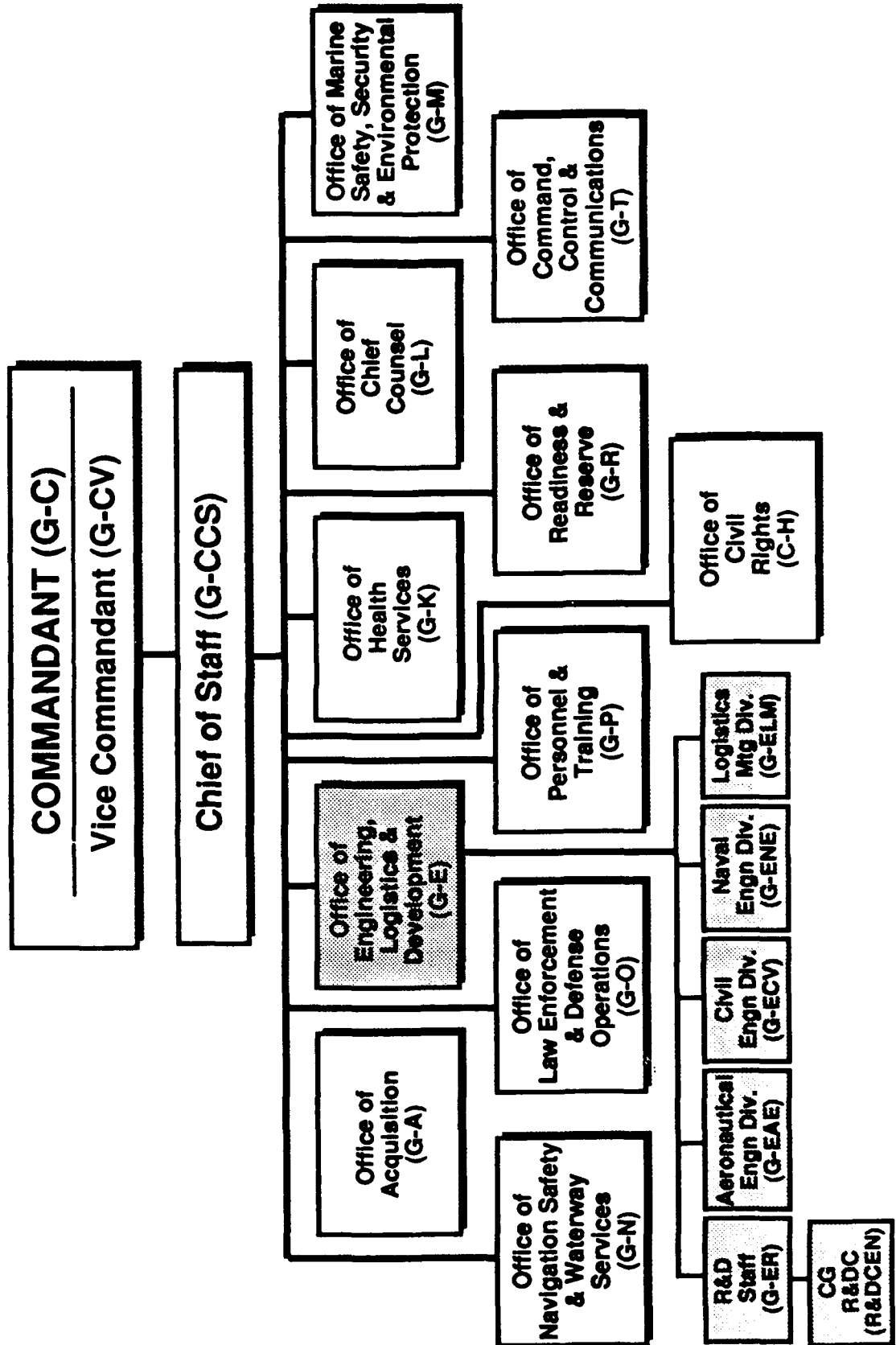


# APPENDIX III

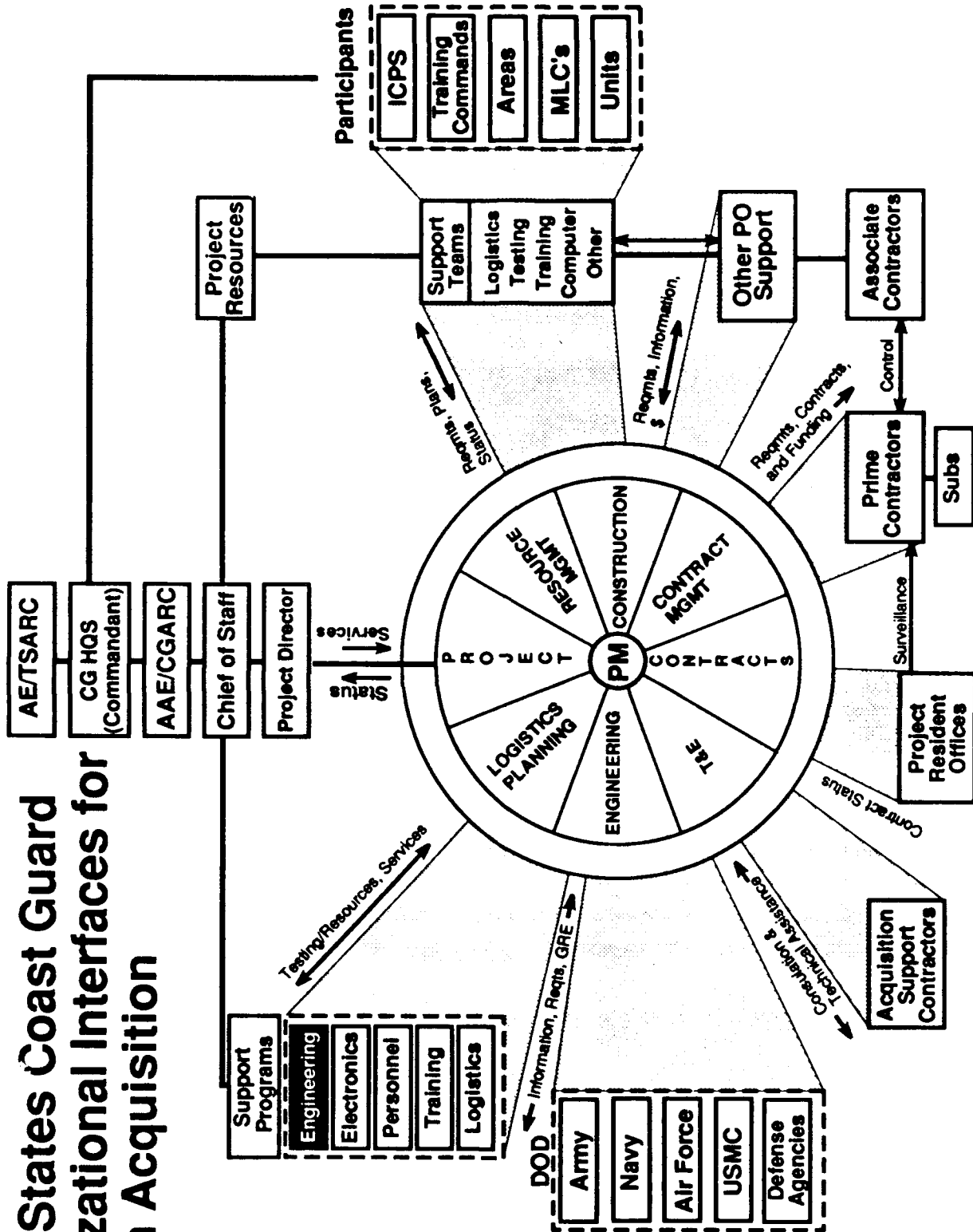
## R & D EXPENDITURES BY OTHER AGENCIES

<u>AGENCY</u>	<u>FY</u>	<u>TOTAL BUDGET</u>	<u>R&amp;D BUDGET</u>	<u>R&amp;D % OF TOTAL</u>
Army	88	\$ 75,813	\$ 4,677	6.2%
	89	\$ 78,164	\$ 5,177	6.5%
	90	\$ 80,511	\$ 5,603	7.0%
Navy	88	\$100,281	\$ 9,479	9.5%
	89	\$ 97,407	\$ 9,345	9.6%
	90	\$101,670	\$10,184	10.0%
Air Force	88	\$ 88,324	\$15,058	17.0%
	89	\$ 94,324	\$14,679	15.5%
	90	\$100,460	\$14,772	14.7%
FAA	88	\$ 2,385	\$ 153	6.5%
	89	\$ 2,974	\$ 160	5.4%
	90	\$ 2,176	\$ 165	7.6%
Coast Guard	88	\$ 2,654	\$ 18.8	00.71%
	89	\$ 2,992	\$ 18.8	00.63%
	90	\$ 3,042	\$ 18.8	00.67%

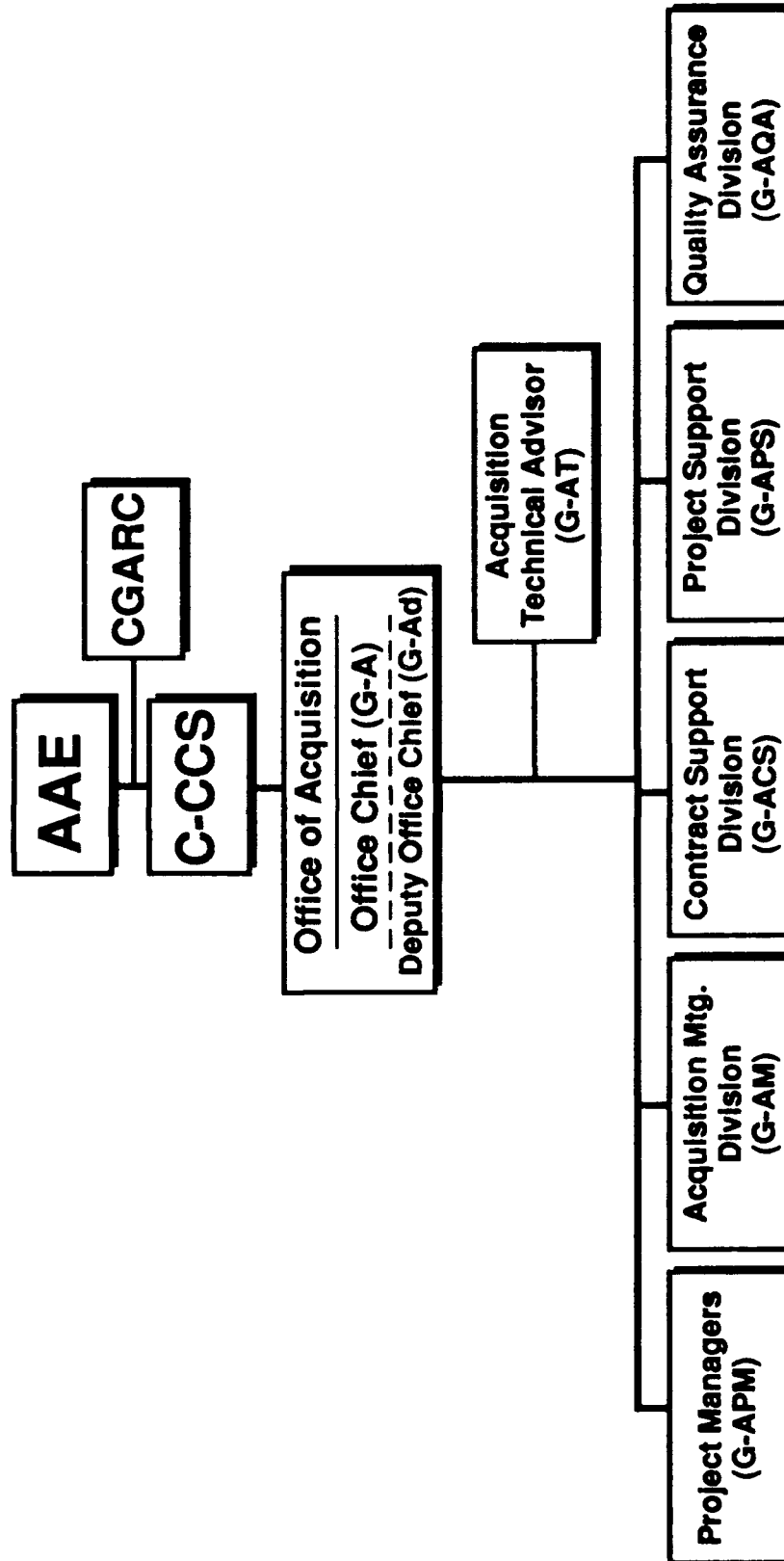
# Department of Transportation United States Coast Guard Organization



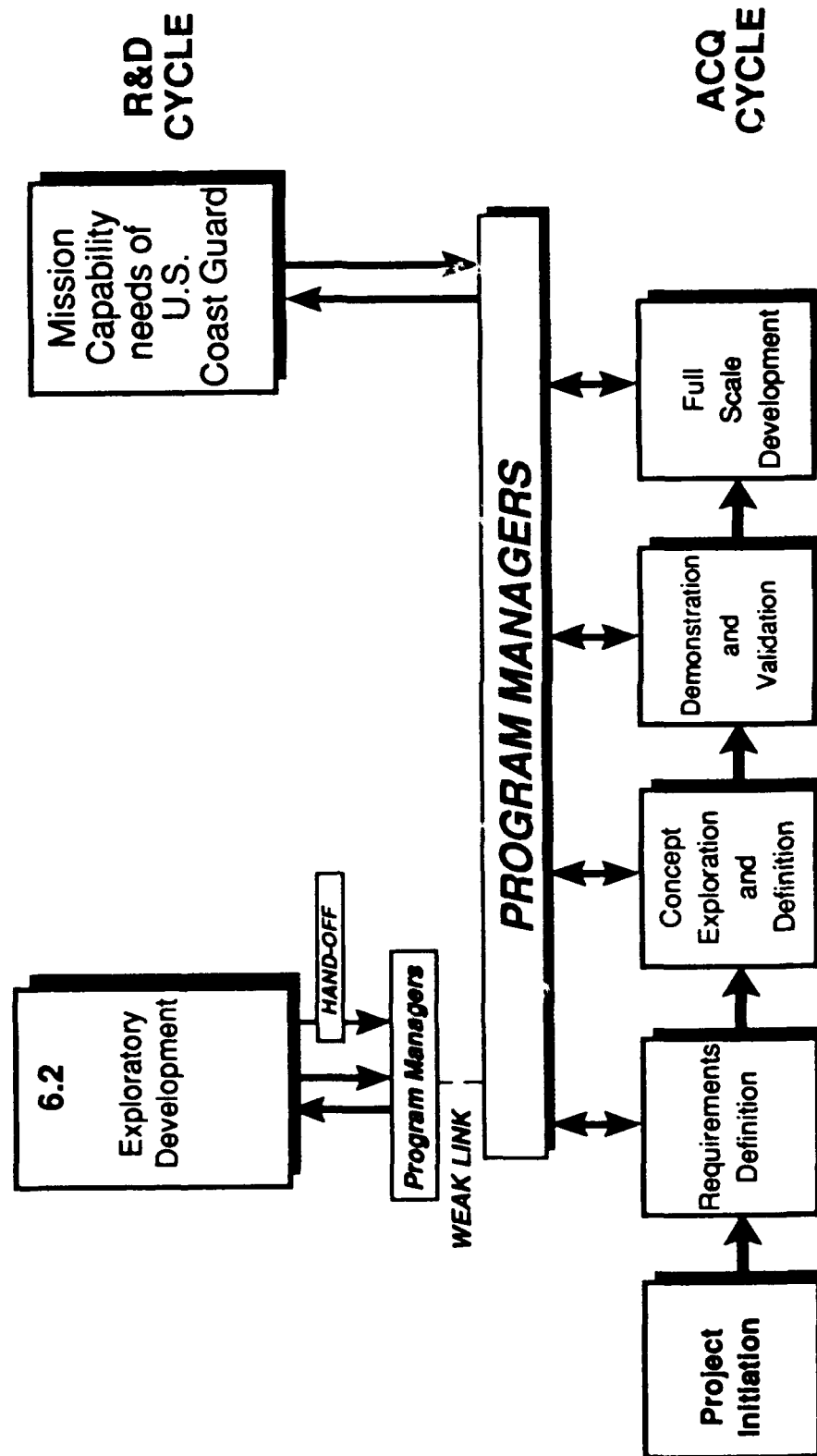
# United States Coast Guard Organizational Interfaces for System Acquisition



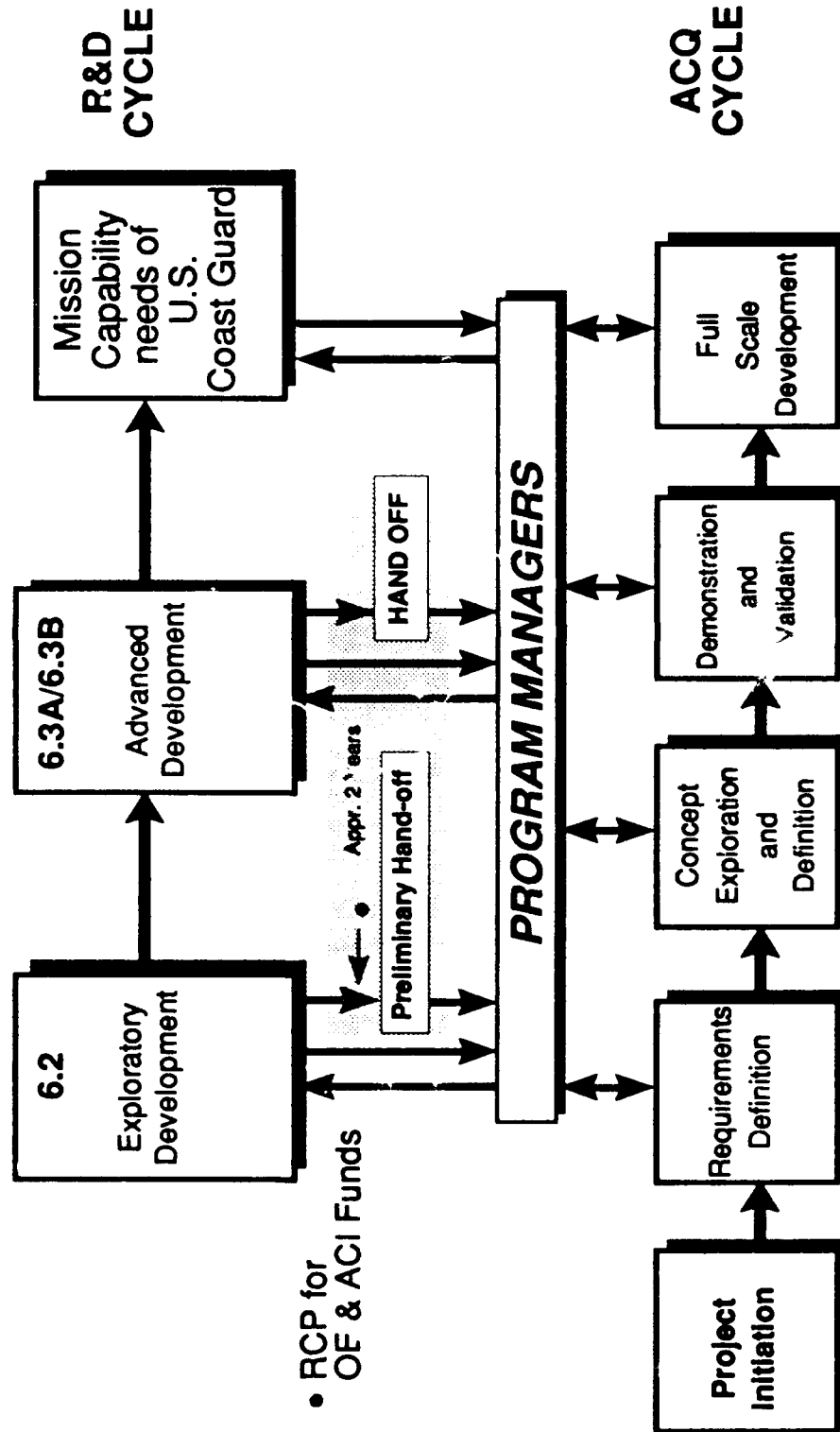
# United States Coast Guard Office of Acquisition Organization



# Functional View of USCG Research and Development Process



# Functional View of Proposed USCG Research and Development Process





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